

## THE INFLUENCE OF THE NUTRITIONAL FACTORS ON SOME BIOPHYSICAL PARAMETERS OF THE RUMINAL FLUID

### INFLUENȚA FACTORILOR NUTRIȚIONALI ASUPRA UNOR PARAMETRI BIOFIZICI AI FLUIDULUI RUMINAL

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*At this hour, a large part of the products obtained through biotechnologies are used in animal fodder, thus contributing to the enhancement of the animal products obtained in economical conditions through optimising the nutrition. In the present study, we wanted to pursue the influence of a high level of cereal in fodder rations, as well as the effect of the yeast *Saccharomyces cerevisiae*, *Yea Sacc*<sup>1026</sup> strain on some biophysical parameters of the ruminal fluid, such as: pH, density and superficial tension. It has been noted, that *Yea Sacc*<sup>1026</sup> improves the pH and the superficial tension, which represents more stable ruminal fermentation when using fodder rations with a high level of barley.*

**Key words:** pH, superficial tension, ruminal fluid, sheep

#### Introduction

Cereals represent the main source of energy in fodder rations for ruminants. The rate and measure of the ruminal digestion depend on a whole series of complex interactions between the cereals and the ruminal microorganisms.

In the present, the effects of supplements based on fodder yeast on the microorganism cultures in the rumen can explain a lot of the benefic results on the ruminants.

#### Materials and Methods

In the experiments, we used a ram of 40 kg weight, fitted with ruminal cannula. The ram was fed 12 days with diets based on alfalfa hay 100% (M) and after that with rations with various proportions of barley (R<sub>1</sub>=20%; R<sub>2</sub>=40%; R<sub>3</sub>=60%; R<sub>1</sub>' =20% + *Yea Sacc*<sup>1026</sup>; R<sub>2</sub>' =40% + *Yea Sacc*<sup>1026</sup>; R<sub>3</sub>' =60% + *Yea*

Sacc<sup>1026</sup>). The yeast *Saccharomyces cerevisiae* Yea Sacc<sup>1026</sup> strain came from the firm Alltech and was added in rations 1.5 g/day. Water was administrated abundantly.

The ruminal content was harvested every 2 days before feeding and at various moments after feeding (at 2, 3 and 5 hours). After harvesting, the fluid was mechanically filtered and held at 39°C in order to determine the density and the superficial tension of the ruminal fluid. The pH was determined immediately after harvesting. The determinations were made with instruments and standard methods in the biophysics laboratory [1]. The chemical composition of the fodder was determined using standard methods in the nutrition laboratory.

## Results and Discussions

The chemical composition of the fodder used in the structure of the rations is presented in Table 1.

Table 1.

Chemical composition of the fodders

| Specification | DM (%) | BP (%) | OS (%) | Ash (%) |
|---------------|--------|--------|--------|---------|
| Alfalfa hay   | 89.40  | 13.51  | 80.73  | 8.67    |
| Barley        | 90.08  | 10.69  | 87.73  | 2.35    |

The experimental data obtained for pH, density and superficial tension of the ruminal fluid are presented in Table 2.

Enhancing the proportion of cereals in fodder rations for sheep, leads to a modification of the biophysical parameters of the ruminal fluid. Rations with a high energy level tend to reduce the ruminal pH, enhance the concentrations of volatile fatty acids, especially lactic acid, and modify the ruminal bacteria population [2, 3, 4].

When the barley proportion in the diet was 60%, we observed a decrease of pH from 7.04 (M) to 6.74 (R<sub>3</sub>). 3 hours after feeding, in all types of rations, except R<sub>2</sub>, the pH level was at a minimum.

The fodder yeast cultures influence the ruminal fermentation, enhancing the pH from 6.11 (R<sub>3</sub>) to 6.52 (R<sub>3</sub>'). The best enhancement of the pH when adding yeast was noted when the barley proportion in the ration reached 40%.

The fodder yeast in the ration enhances the pH in every diet in comparison with not adding it, which matches the data obtained from literature [5].

At animals fed with rations with a high energy level and yeast, the decrease of the lactic acid concentration is associated with a higher ruminal pH and represents a feature of much more stable ruminal fermentation.

The experimental data reveal that adding the yeast *Saccharomyces cerevisiae*, Yea-Sacc<sup>1026</sup> strain leads to a decrease of the superficial tension from 60.94 (M) to 53.48 (R<sub>2</sub>'). When using R<sub>2</sub>' we obtain the biggest decrease in

comparison with R<sub>2</sub> (without yeast) from 68.47 (R<sub>2</sub>) to 53.48 (R<sub>2'</sub>) before feeding, as well as after (especially at 2 and 3 hours after feeding). This means that the yeast has a tensioactive effect.

Table 2.

Medium values of the biophysical parameters

| Biophysical parameters                           | Type of diet    | Number of hours since feeding |        |        |        |
|--|-----------------|-------------------------------|--------|--------|--------|
|  |                 | 0                             | 2      | 3      | 5      |
| Density (kg/m <sup>3</sup> )                     | M               | 1.0089                        | 1.0021 | 1.0014 | 1.0013 |
|  | R <sub>1</sub>  | 1.0043                        | 1.0036 | 1.0048 | 1.0024 |
|  | R <sub>2</sub>  | 1.0023                        | 1.0053 | 1.0030 | 1.0050 |
|  | R <sub>3</sub>  | 0.9955                        | 1.0030 | 1.0033 | 1.0014 |
|  | R <sub>1'</sub> | 1.0029                        | 1.0045 | 1.0081 | 1.0080 |
|  | R <sub>2'</sub> | 1.0053                        | 1.0068 | 1.0074 | 1.0054 |
|  | R <sub>3'</sub> | 1.0059                        | 1.0049 | 1.0061 | 1.0050 |
| pH   | M               | 7.04                          | 6.74   | 6.70   | 6.81   |
|  | R <sub>1</sub>  | 7.05                          | 6.34   | 6.23   | 6.60   |
|  | R <sub>2</sub>  | 6.98                          | 6.12   | 6.17   | 6.31   |
|  | R <sub>3</sub>  | 6.74                          | 6.49   | 6.11   | 6.47   |
|  | R <sub>1'</sub> | 7.09                          | 6.41   | 6.37   | 6.42   |
|  | R <sub>2'</sub> | 6.96                          | 6.60   | 6.49   | 6.56   |
|  | R <sub>3'</sub> | 6.83                          | 6.47   | 6.52   | 6.62   |
| Superficial tension $\sigma \cdot 10^{-3}$ (N/m) | M               | 60.94                         | 64.78  | 62.51  | -      |
|  | R <sub>1</sub>  | 61.15                         | 64.98  | 62.82  | 57.49  |
|  | R <sub>2</sub>  | 68.47                         | 69.81  | 67.88  | 60.81  |
|  | R <sub>3</sub>  | 69.75                         | 68.19  | 64.92  | 66.88  |
|  | R <sub>1'</sub> | 63.49                         | 63.08  | 61.34  | 63.31  |
|  | R <sub>2'</sub> | 53.48                         | 58.37  | 59.74  | 61.20  |
|  | R <sub>3'</sub> | 67.63                         | 68.78  | 69.68  | 68.02  |

Between the superficial tension and the pH we found a marginal linear correlation (-0.2444), which is expected, because the volatile fatty acids influence the superficial tension very little.

Between the experimental values obtained for the density of the ruminal fluid and the other biophysical parameters investigated, certain correlations weren't observed. The linear correlation coefficient between pH and relative density was -0.1213, which means, that the relative density of the ruminal fluid doesn't have any influence on its pH. The correlation coefficient between the superficial tension and the relative density was -0.2774, which indicates a marginal correlation.

## Conclusions

1. The pH values are over 6, which are considered the best for ruminal fermentation.
2. Using the fodder yeast in the ration enhances the pH and the superficial tension. The fodder yeast cultures influence the ruminal fermentation, enhancing the pH from 6.11 (R<sub>3</sub>) to 6.52 (R<sub>3</sub>') and experimental data reveal that adding the yeast *Saccharomyces cerevisiae*, Yea-Sacc<sup>1026</sup> strain leads to a decrease of the superficial tension from 60.94 (M) to 53.48 (R<sub>2</sub>').
3. The capacity of the yeast to prevent the accumulation of lactic acid in the rumen shows a role in overcoming ruminal dysfunctions, using yeast when administrating rations with high energy levels in ruminants.

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